

## Part 1: What is a Dragster?



## What is a Dragster?

- A **dragster** is a car that is aerodynamically designed for speed
- **Drag racing** is a sport in which cars or motorcycles race down a track with a set distance as fast as possible



## Types of Dragsters

- Over 200 classes with 12 categories

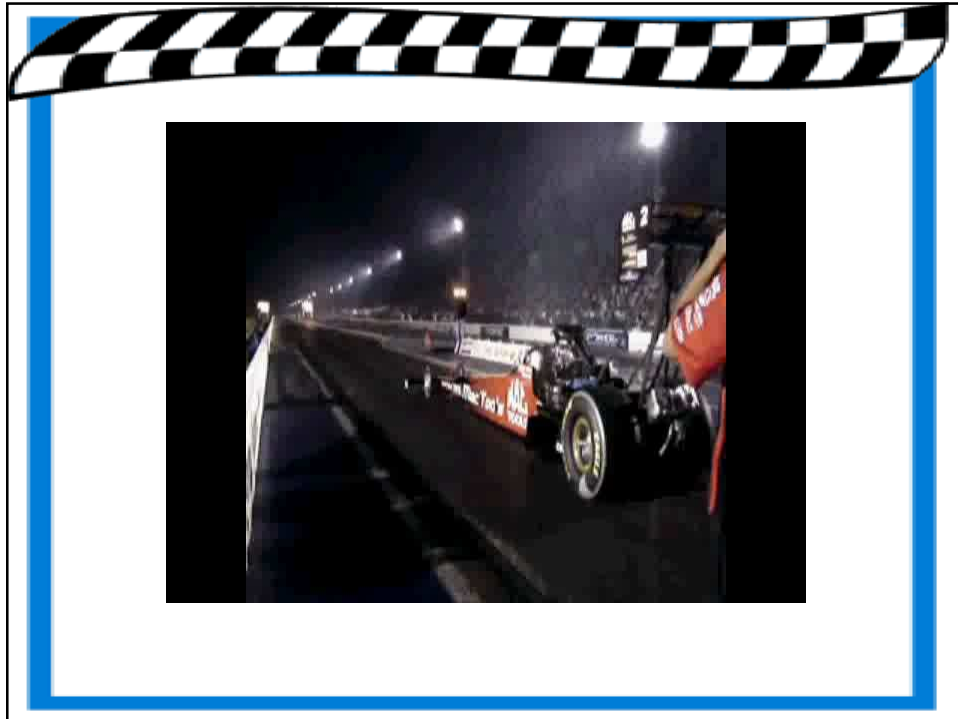


- Top Fuel
- Funny Car
- Pro Stock
- Top Alcohol Dragster
- Super Stock
- Stock
- Super Comp
- Super Gas
- Super Street



<http://www.nhra.com/aboutnhra/classes.htm>





## What is a CO<sub>2</sub> Dragster?

- **CO<sub>2</sub> dragster cars** are model dragsters cars. They are designed for speed and use CO<sub>2</sub> catridges for power.



## CO<sub>2</sub> Dragster Video

Deron & Elijah vs  
Chelsea & Sammy



## CO<sub>2</sub> Dragster Video

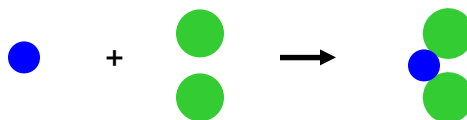
## The Dragster Body

- Basswood Body Blank
- 12in long
- CO<sub>2</sub> hole is already drilled



## The CO<sub>2</sub> Cartridge

Carbon      Oxygen      Carbon dioxide  
C            O            CO<sub>2</sub>

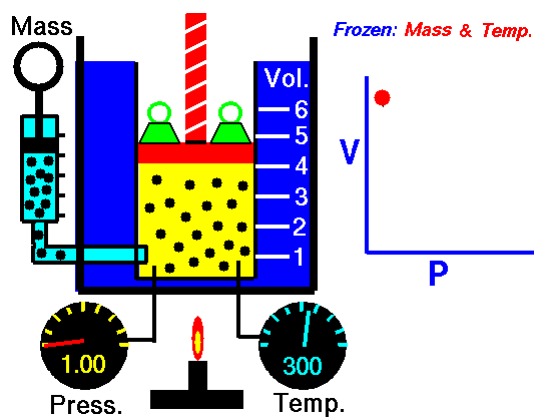


## The CO<sub>2</sub> Cartridge

- Boyle's Law: the volume of a gas is inversely proportional to the pressure that is applied when the temperature is constant.



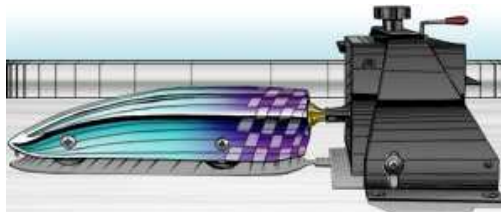
## CO<sub>2</sub> cartridge



## CO<sub>2</sub> cartridge

- Filled with pressurized carbon dioxide gas and then sealed.
- The CO<sub>2</sub> is *confined* to a small container; the *volume* of the gas would be much greater if it were released into the air.
- The large volume of CO<sub>2</sub> can fit inside the small cartridge because of the *pressure* that has been applied to it.

## CO<sub>2</sub> Dragsters






## CO<sub>2</sub> Dragsters



## CO<sub>2</sub> Dragsters





## Part 2: Engineering Principles



## Engineering Principles

- Newton's Laws of Motion
- Aerodynamics
- Mass
- Drag
- Friction



## 2<sup>nd</sup> Law of Motion

$$F = ma$$

F = force

m = mass

a = acceleration

Acceleration is dependent upon the mass and force of the car.

- For a fast car, you need:
  - Big force
  - Light car

## Newton's 3rd Law of Motion


- The driving principle behind these cars  
"For every action, there is an equal and opposite reaction."



The **#1** most important factor in the speed of your dragster car is...

**Mass**

✓ Cars with less mass go much faster!

A digital scale with a red weight on it. The scale is white with a digital display showing '0.0'. The weight is red and has the word 'FINDIT' on it.

**Friction**

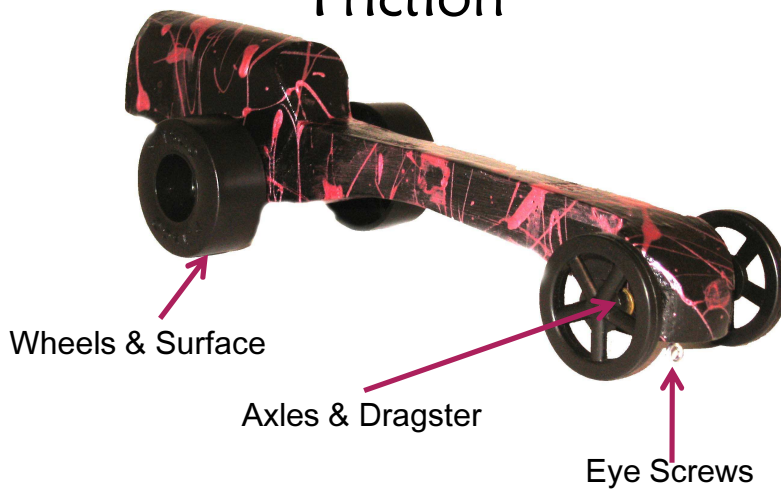
- The 2<sup>nd</sup> Most Important Factor!
- Thanks to our friend gravity, everything has friction.
- On a CO<sub>2</sub> car, friction occurs primarily in three places:
  - between the wheels and the ground,
  - between the axles and the car body,
  - between the eye-hook and the fish line track.

## Friction

- So how do you eliminate friction?
- You can't. You can only reduce friction.
- So how can we do that?



## Friction





## Reducing Friction

- Make sure the axle & tires are free to rotate.
- Make sure the wheels are not rubbing on the car body.
- Be sure to install your eye-hooks properly. Poorly aligned eye-hooks are often the cause of a slow car.



## Aerodynamics

- The 3<sup>rd</sup> Most Important Factor!
- What is aerodynamics?
- The word comes from two Greek words: **aerios**, concerning the air, and **dynamis**, which means force.
- **Aerodynamics** is the study of forces and the resulting motion of objects through the air.

## Drag

- **Drag** is the resistance of wind moving over an object.



Image source: <http://www.pitsco.com>

## Drag

- **The Balancing Act:**
  - **Advantages:**  
Aerodynamically shaped cars have less drag so they go faster.
  - **Disadvantages:**  
Aerodynamically "clean" cars are more difficult to build.

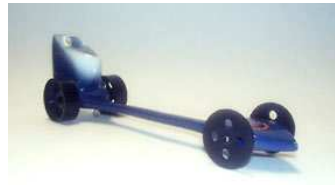
## Types of CO<sub>2</sub> Cars

- Rail Cars
- Shell Cars
- Show Cars
- Normal Cars



## Rail Cars

- **General Characteristics:**
  - A narrow "rail" that connects the front axle to the back of the car.
  - Typically use external wheels (wheels on the outside of the body).
  - The body of the car is usually lower to the ground in the front and middle and then rises up abruptly to hold the CO2 cartridge.





## Rail Cars

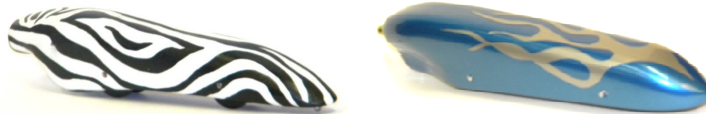


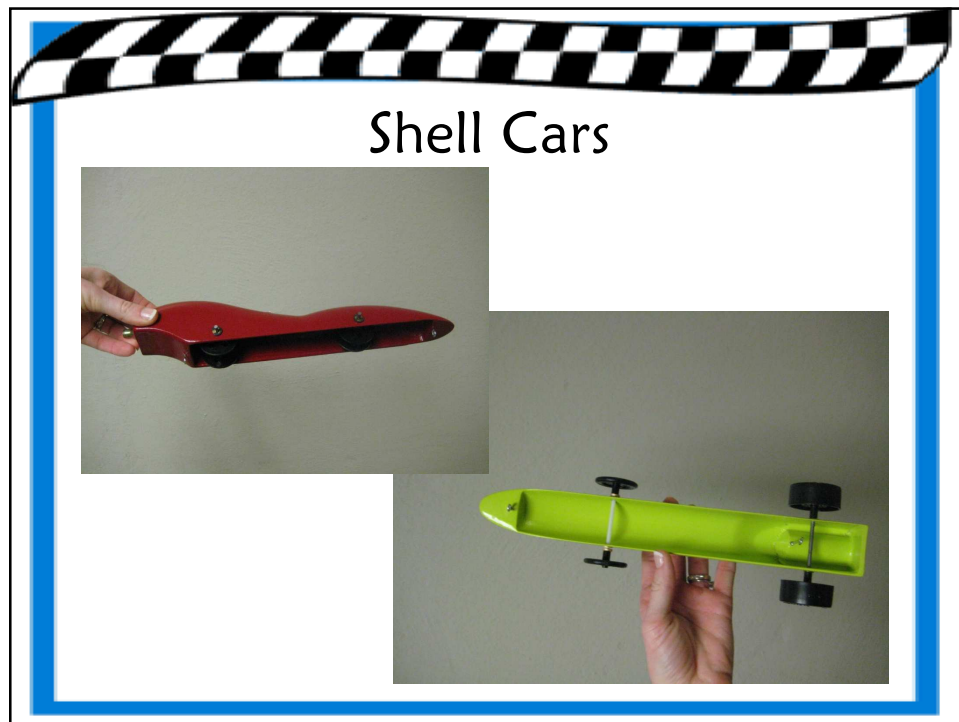
- **Pros:**
  - Easiest to build and design.
  - Thin rails reduce weight of the car, increasing speed.
  - Can be built with normal wood working tools by most normal students.
- **Cons:**
  - The thinner the rail, the greater chance of structural failure (breaking).
  - Exterior wheels are bad for aerodynamics.
  - Body shape tends to encourage drag and hamper good aerodynamics.

## Shell Cars

### General Characteristics:

- Internal wheels.
- Clean aerodynamic "bullet" shape.
- Hollow underside forming a thin "shell" body.






## Shell Cars

•Pros:

- Very low drag aerodynamic shape.
- Usually capable of high speeds by design.

•Cons:

- Requires special wheels, axles and attachment clips
- More difficult to build
- Shell cars tend to all look similar reducing individual creative expression.
- Often requires special tools such as a CNC lathe and CAD program.



## Show Cars

### General Characteristics:

- Stunning design.
- High degree of creativity in the design.
- Usually very intricate and delicate in their construction.
- Very showy paint jobs with glass like finishes.



## Normal Cars

### General Characteristics:

- Normal cars are built to race.
- Normal cars may use characteristics of other car styles.
- Although the wheels are usually external, Normal Cars sometimes have internal front wheels.



## Normal Cars

### Pros:

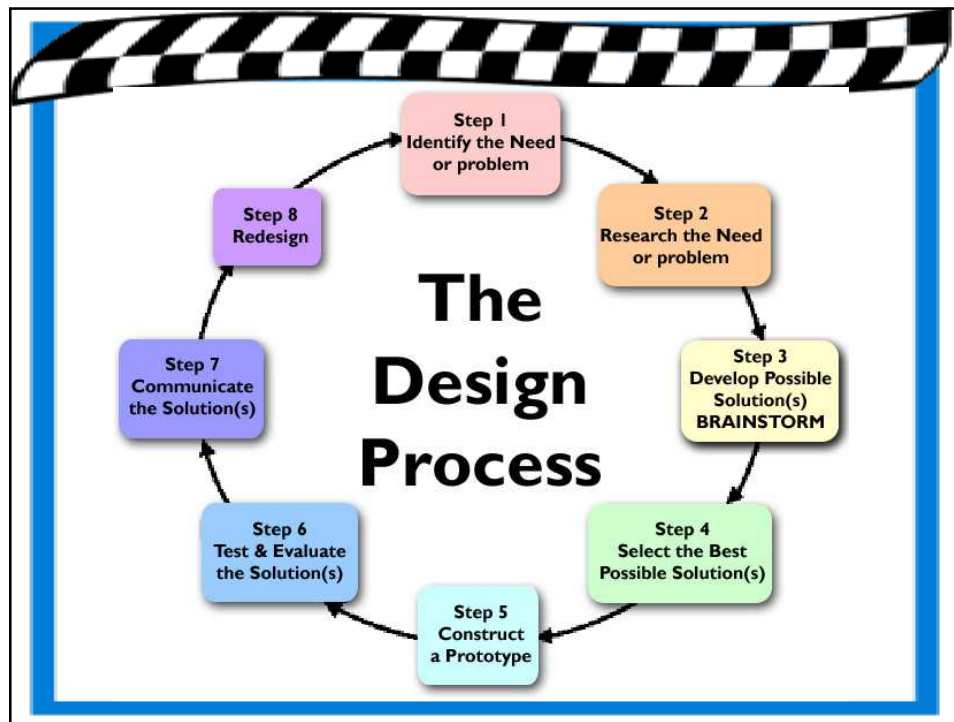
- Totally reflects the skills, abilities and creativity of the designer/builder.
- Always gets to race, and often does well at the school level.
- Can be built by the average student with average ability and normal tools.
- Doesn't require any special parts or materials.

### Cons:

- May or may not be competitive on a national level.

## Part 2: Making a Dragster






## How do you make a Dragster?

Design Process

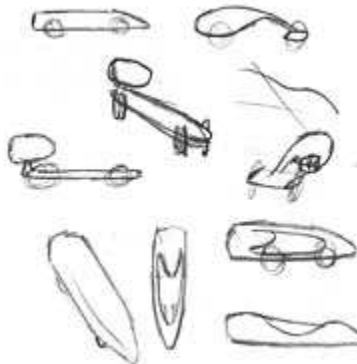
- Step 1: Research
- Step 2: Identify Requirements
- Step 3: Design
- Step 4: Construction
- Step 5: Test
- Step 6: Evaluate



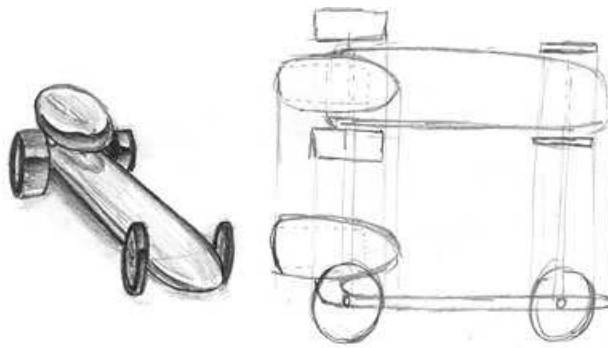
## Design Requirements

REQUIREMENTS	SPECIFICATIONS	POINTS
*Total Length	200mm-305mm	/10
*Body height with wheels	Max = 75mm	/10
*Front body width at axles	30mm – 42mm	/10
*Back body width at axles	35mm – 42mm	/10
*Minimum body width (All points other than axles)	13mm	/10
*Thickness around CO <sub>2</sub> cartridge	3mm	/10
*Axle distance from rear of car	9mm – 100mm	/10
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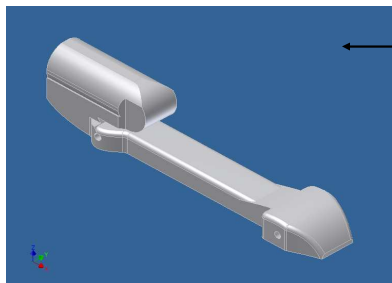
## Brainstorm Ideas



Choose best design

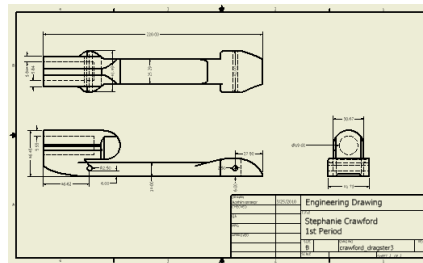


CAD with Autodesk Inventor



Design

Engineering Drawing



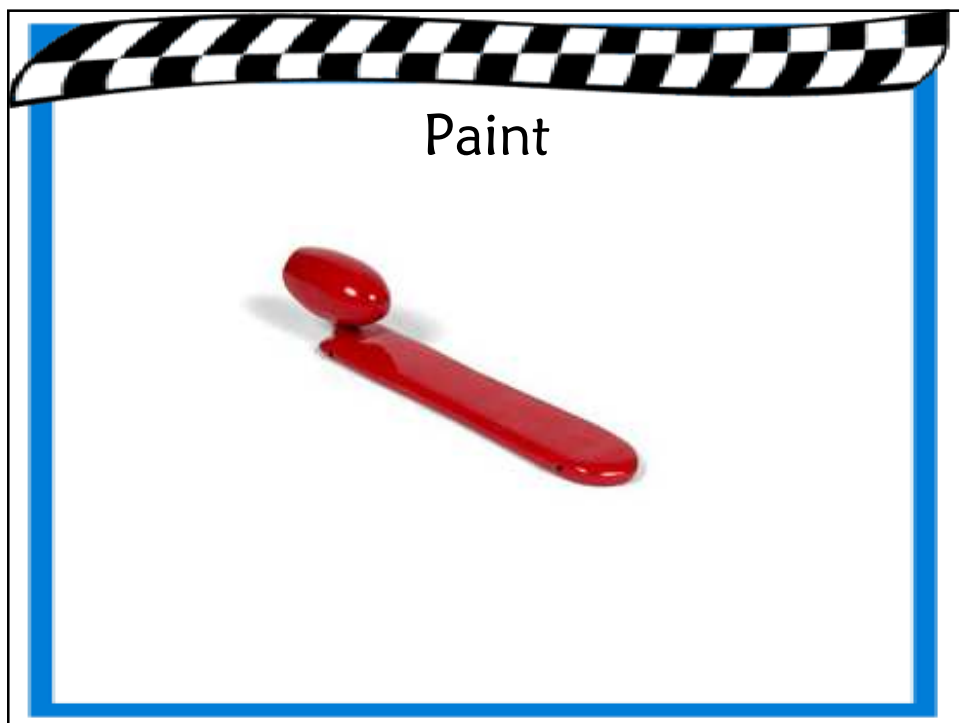
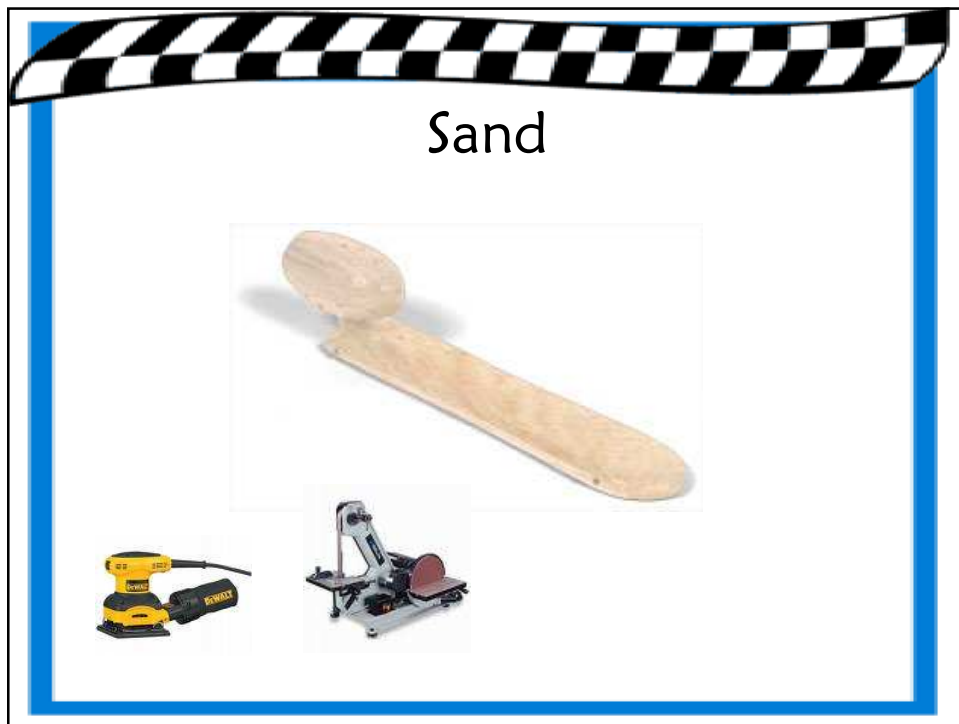
Draw Top & Side View



Cut out on bandsaw







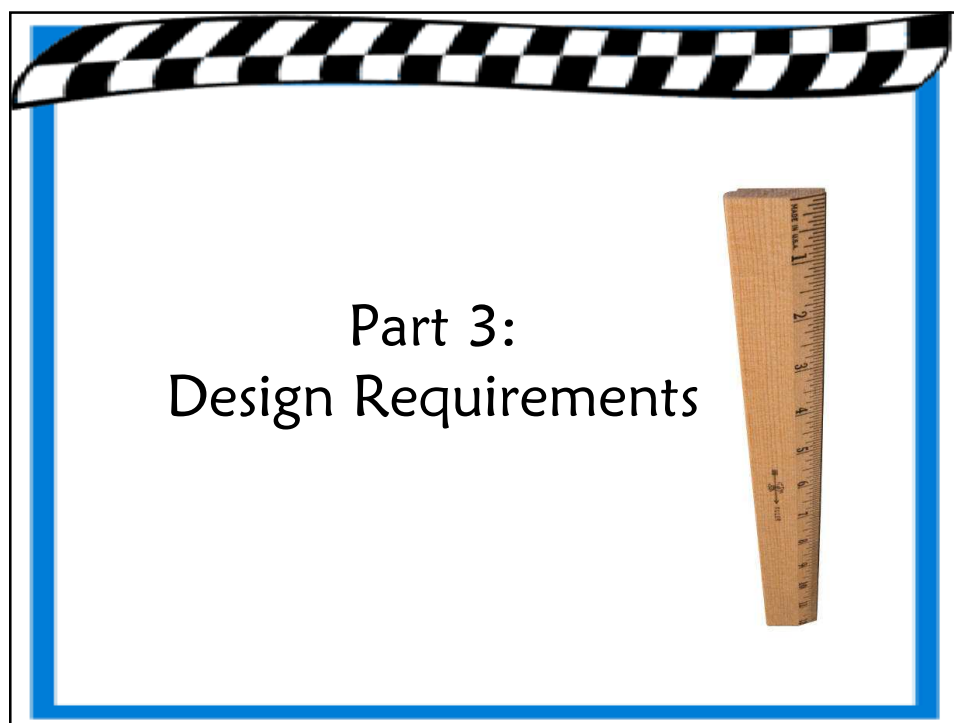
Add wheels & axles



Test!

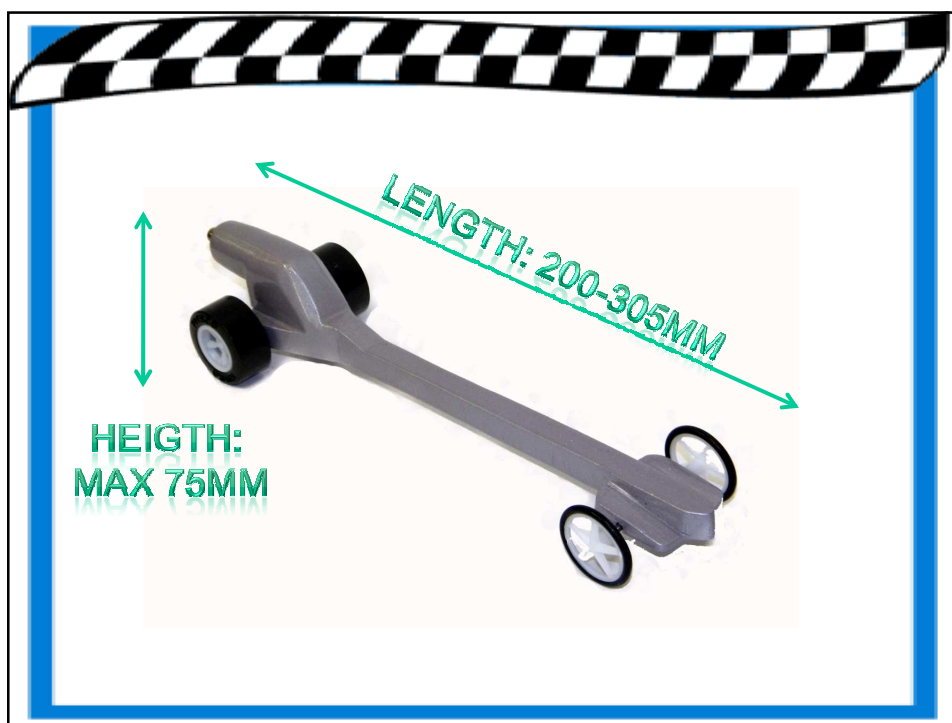


Conor & Andrew vs  
Tyler & Clint



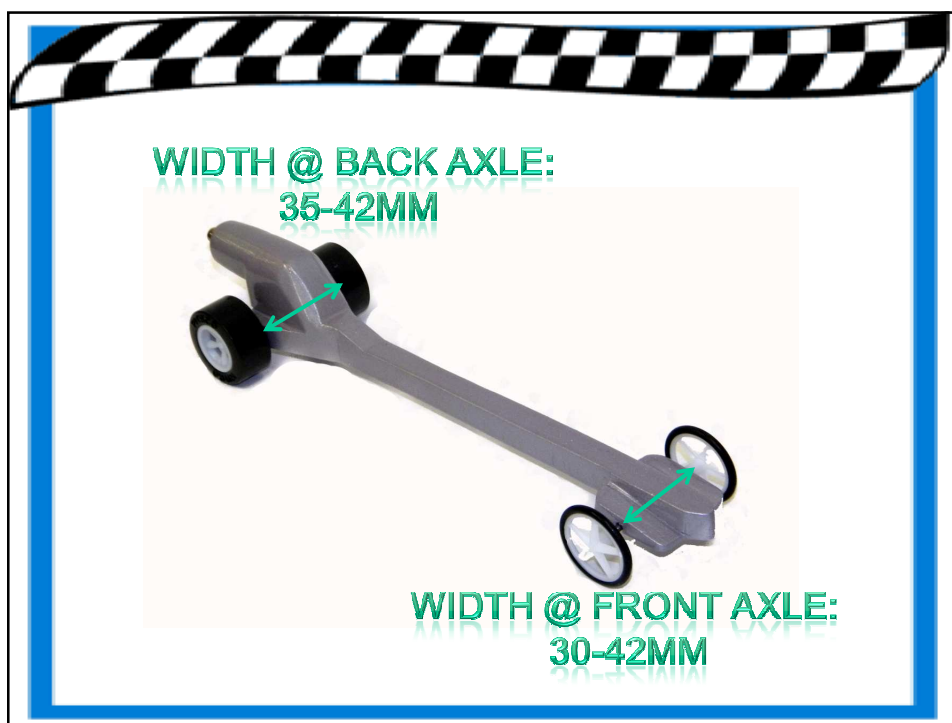
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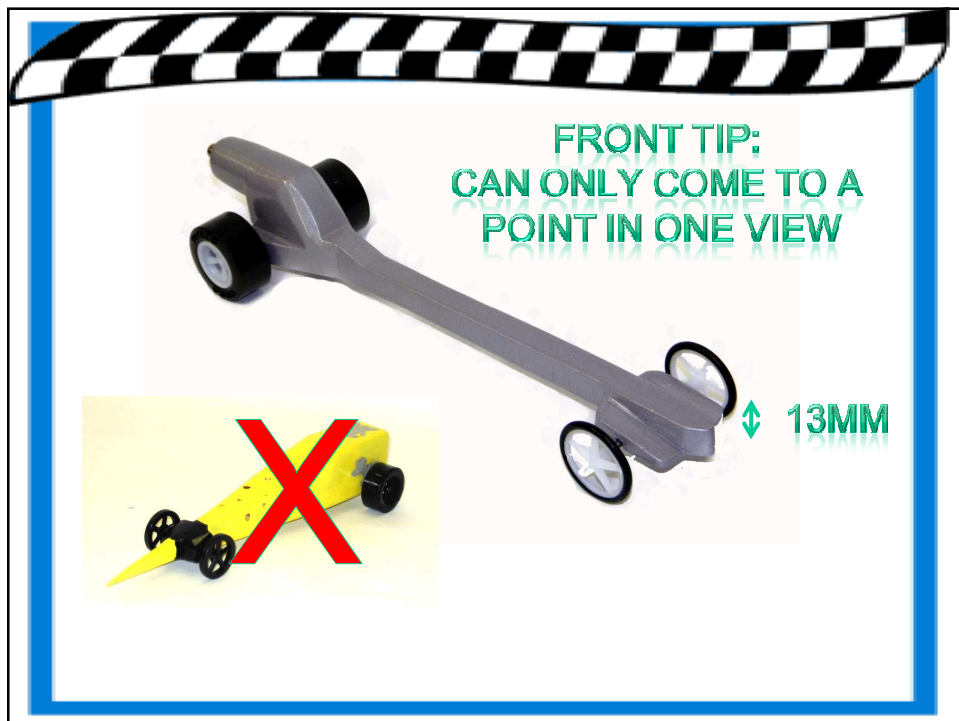
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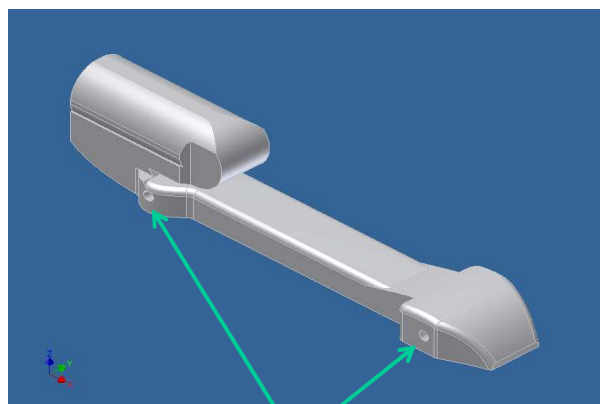
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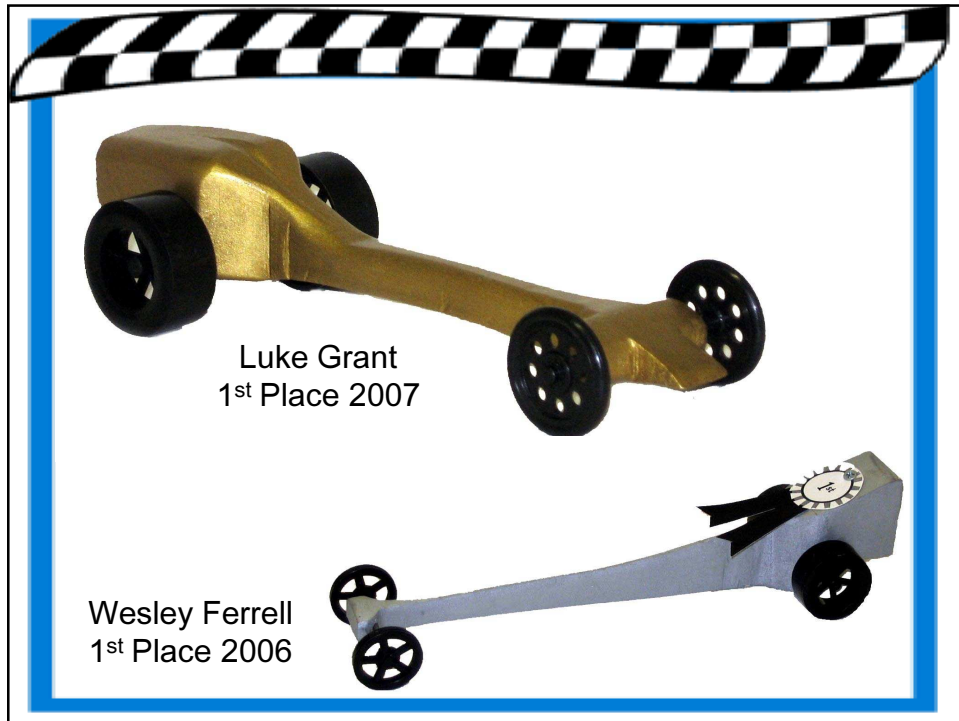
**5-9MM  
THICKNESS AROUND  
AXLE HOLES**



## Design Requirements

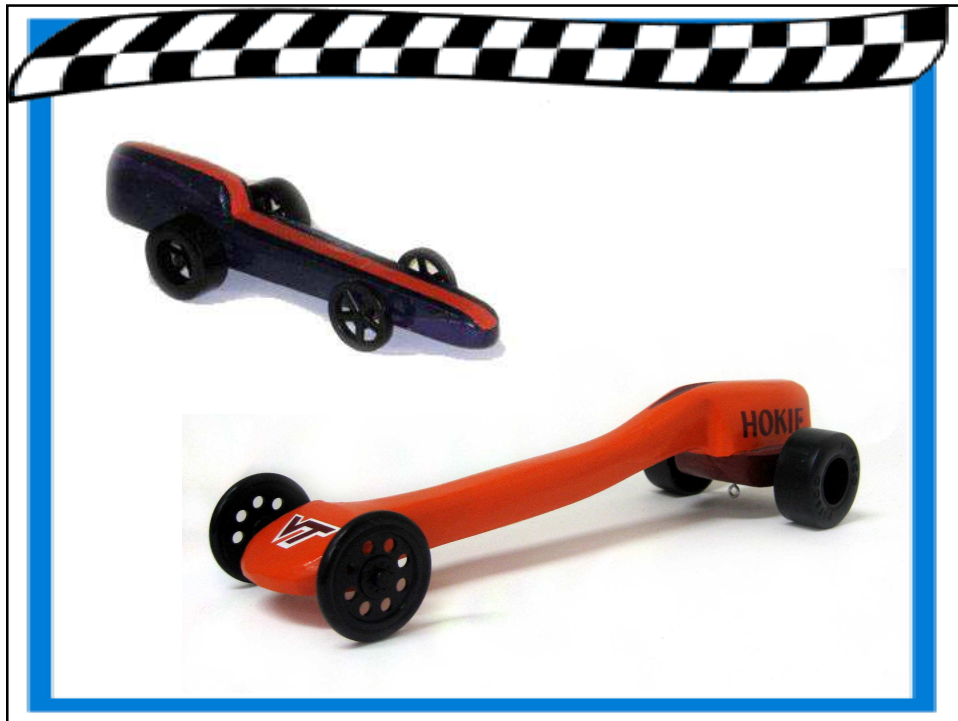
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## Student Examples









Tales Pimentas and Scott Herman







